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NAVAL AIR DEVELOPMENT CENTER WARMINSTER PA AIRCRAFT --ETC F/G 14/5  
FEI CAMERA SYSTEM, ACCEPTANCE TEST AND CHECKOUT PROCEDURE, AS I--ETC(U)  
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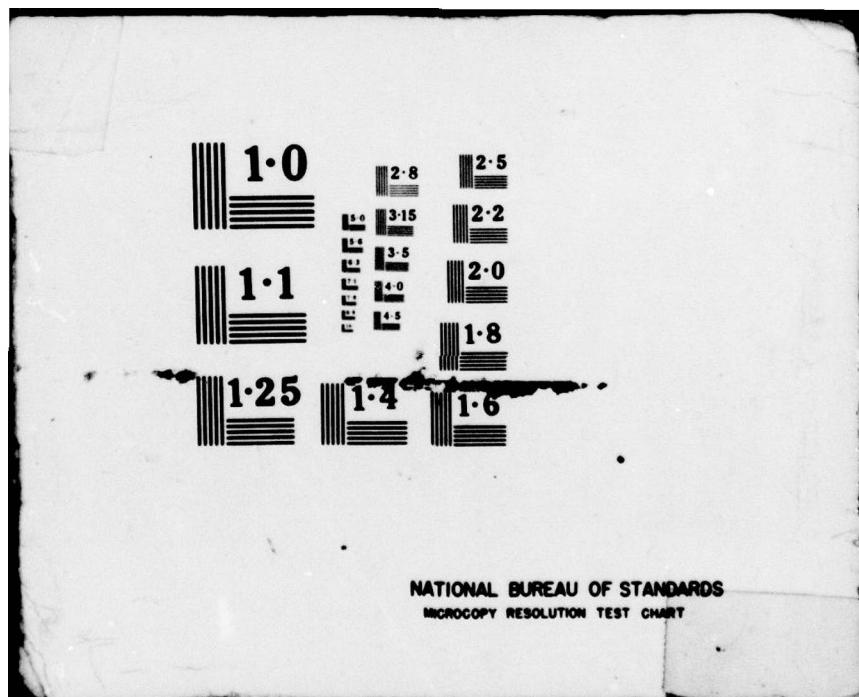
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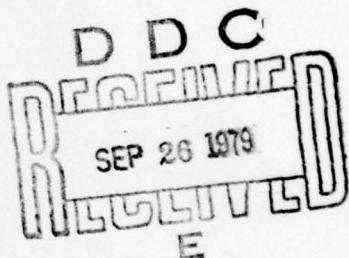
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FEI CAMERA SYSTEM, ACCEPTANCE TEST AND CHECKOUT  
PROCEDURE, AS INSTALLED IN BQM-34A/S AND BQM-34E/T

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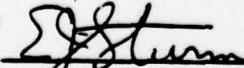
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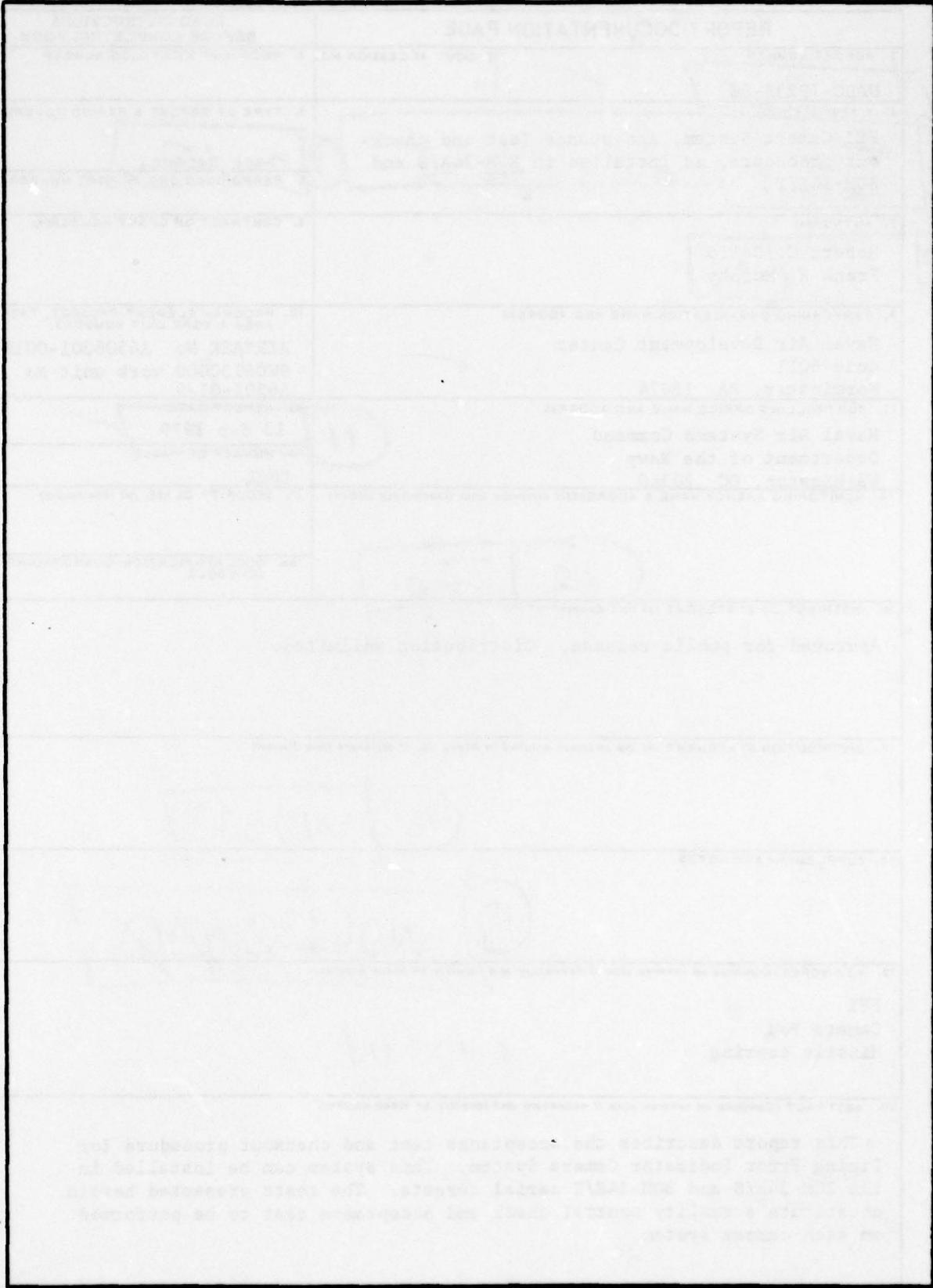
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SUMMARY

This report describes the acceptance test procedure for the Firing Error Indicator Camera System. This system can be installed in the BQM-34A/S and BQM-34E/T aerial targets. The tests presented herein constitute a quality control check and acceptance test to be performed on each camera system.

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CONTENTS

- SECTION I - Acceptance Test for FEI Camera Control Box P/N TE 21330. This test can be conducted in the shop or while installed in an aerial target.
- SECTION II - Checkout Procedure for FEI Camera Control Box P/N TE 21330 and Wing Wiring as Installed in the BQM-34A/S or BQM-34E/T Aerial Targets. This section does not include testing of the FEI Camera Pods, which are checked in section III.
- SECTION III - Checkout Procedure for FEI Camera Pod P/N TE 21300. Camera mechanisms are checked individually during this bench test.
- SECTION IV - Checkout Procedure for the FEI Camera System as Installed in the BQM-34A/S or BQM-34E/T targets. The camera pods are checked individually during this test.
- SECTION V - Procedure for FEI Camera Pod Assembly and Disassembly.

SECTION I

1.1. General

This section describes the component acceptance test for the FEI Camera Control Box. The test can be conducted in the shop or while installed in an aircraft.

1.2. Preliminary Check

1.2.1 Visual Inspection

Visually inspect the unit for obvious faults or evidence of poor workmanship. Record comments on test data sheet.

1.3. Functional Tests

1.3.1 Preliminary Adjustments

1.3.1.1 Assemble test set-up as shown in Figure 1 using equipment listed in Table I.

1.3.1.2 On Test Box place circuit breaker in the OFF position.

1.3.1.3 On the FEI Camera Control Box (CCB) place the TIME-SEC switch to the 10 second position.

1.3.1.4 On the Time Base Coder (TBC)Ground Station place 560 OHMS switch to the IN position and POWER ON. Set Output level to 400 mV by adjusting R 29, COMMAND SIGNAL GAIN.

1.3.2. Test Procedure

1.3.2.1 Place circuit breaker on Test Box to the ON position. The following lamps shall come ON:

PWR  
SLO SPD 1  
SLO SPD 2  
MOTOR 1 (E and L)  
MOTOR 2 (E and L)

1.3.2.2 After approximately three (3) seconds, the HEATER 1 (A and B) and HEATER 2 (A and B) lamps shall come ON and the following lamps shall go OFF:

SLO SPD 1  
SLO SPD 2  
MOTOR 1 (E and L)  
MOTOR 2 (E and L)

1.3.2.3 Key CAMERAS ON. All heater lamps will go out. MOTOR 1 (E and L) and MOTOR 2 (E and L) will come ON. After  $10 \pm 1$  seconds, all Motor lamps will go out, and all heater lamps will come ON. (The timing lights will be ON continuously, not flashing, until the Time Code Generator signal is present, as in step 1.3.2.11).

Record results on test data sheet.

1.3.2.4 On the FEI CCB, place the TIME-SEC switch to the 20 second position.

1.3.2.5 Repeat paragraph 1.3.2.3. Results shall be the same, except time delay will be  $20 \pm 1\frac{1}{2}$  seconds.

1.3.2.6 On the FEI CCB, place the TIME-SEC switch to the 40 second position.

1.3.2.7 Repeat paragraph 1.3.2.3 Results shall be the same, except time delay will be  $40 \pm 2$  seconds.

1.3.2.8 Place the TIME-SEC switch to the 10 second position.

1.3.2.9 Turn ON the Time Code Generator and Oscilloscope. Allow two minutes for warm-up.

1.3.2.10 Inter-Range Instrumentation Group (IRIG) Time Coding. The IRIG Time Code used in the FEI System is format B, as defined in Document 104-70, IRIG Standard Time Formats.

1.3.2.11 Key CAMERAS ON. Verify on the oscilloscope that FEI CCB output code meets the requirements of the preceding paragraph. Monitor the output of J4 (Pod 1) and then monitor at J8 (Pod 2) of the FEI CCB Test Box. Observe the Timing Lights flashing during the simulated camera operation on the FEI CCB Test Box.

1.3.2.12 The preceding steps serve as an aid in initially verifying the operation of the timing system. If the results of the preceding tests are successful, proceed to the next step.

1.3.2.13 Remove the oscilloscope from the test set-up of Figure 1 and connect the oscillograph in its place.

1.3.2.14 Repeat step 1.3.2.11 while now using the oscillograph. Operate the oscillograph for approximately two (2) seconds so as to insure recording one complete cycle. The recorded oscillograph sheets shall be attached to the data sheets and shall become a part thereof.

### 1.3.3 Reporting Test Results

At the conclusion of the prescribed tests, the test data sheet shall be submitted to the cognizant engineer for approval. Upon approval, the Camera Control Box shall be returned to the fabrication shop for sealing of the printed circuit board. Upon completion, the box is then considered acceptable for aircraft installation.

SECTION II

2.1. General

This section describes the checkout procedure for the FEI Camera Control Box and aircraft wing wiring, as installed in the BQM-34A/S or BQM-34E/T. The procedure does not include the FEI camera pods, which are checked in Section III. The CCB shall have successfully passed the tests described in Section I herein prior to performing the following tests.

2.2. Preliminary Check

2.2.1 Visual Inspection

Visually inspect the installation of the system for obvious flaws or evidence of poor workmanship.

2.3. Functional Test

2.3.1 Preliminary Adjustments

2.3.1.1 Assemble the test set-up as shown in Figure 2 using equipment listed in Table I. This set-up checks the wing wiring associated with each pod individually. Connect test cable J1-J2/J3 (-8 for BQM-34E/T, -9 for BQM-34A/S) to test Pod 1 wiring first, then connect test cable to test Pod 2 wiring.

2.3.1.2 On Test Box, place circuit breaker in the OFF position.

2.3.1.3 On the FEI Camera Control Box (FEI CCB) place the TIME-SEC switch to the 10 second position. On the Ground Station place 560 OHMS switch to the IN position, and POWER ON; set Output level to 400 mV by adjusting R29, COMMAND SIGNAL GAIN.

2.3.2 Test Procedure

Perform tests of paragraphs 1.3.2.1 to 1.3.2.11. Connect test cables appropriately to monitor Pod 1 and then Pod 2. Record results on test data sheets.

### SECTION III

#### 3.1. General

This section describes the checkout procedure for the FEI camera pod P/N TE21300. Each camera mechanism will be checked individually during this test to verify proper film speed, brake and clutch operation. This test can be conducted in the lab.

Data presented herein constitutes a functional check to be performed on each FEI camera pod.

#### 3.2. Preliminary Check

##### 3.2.1 Visual Inspection

Visually inspect the FEI camera pod and its two mechanisms for obvious faults or evidence of poor workmanship. Record comments on test data sheet. Disassemble pod as per paragraph 5.2 of Section V.

3.2.2 Check the camera pod fuses, two fuses per mechanism. See Figure 3 for location.

MOTOR (F1) - 15 AMPS  
HEATER (F2) - 10 AMPS

#### 3.3. Functional Test

Prior to mounting the FEI pods to any aerial target for operational use, the following test shall be performed in the laboratory to verify a reliable system.

3.3.1 Assemble the test set-up as shown in Figure 4 using equipment listed in Table I.

##### 3.3.2 Mechanism Lubrication

Prior to testing, each mechanism shall be lubricated per paragraph 4.5 of reference (a).

3.3.3 Test of brake, clutch and film speed shall be conducted on one mechanism at a time. Disconnect the internal connector (MS3116P-10-6S), See Figure 3, from the mechanism not being tested.

NOTE: Timing lights (LED) operation will be verified in Section IV.

3.3.4 Load film in the mechanism to be tested per paragraphs 2.5.0 through 2.5.2.4 of reference (a) using Kodak Ektachrome EF (Speed 160) 16mm short pitch (2-R-2994) Estar base (.004 thick) film using a 400 foot daylight loading spool.

3.3.5 Using a stop watch, key the camera ON. Time a 10 second film run. Three separate 10 second film runs are required. Visually observe the film's path during each film run.

3.3.6 First 10 second film run is for BRAKE OPERATION CHECK as follows: Brake is too tight if running current exceeds 11 amperes. Brake is too loose if slack on supply spool side exceeds that shown in Figure 5.

NOTE: If brake is out of adjustment, only a qualified technician should make corrective adjustments following instructions in reference (a).

3.3.7 Second 10 second film run is for clutch operation check as follows:  
Clutch is too tight if clutch-arm will not fluctuate during run.  
Clutch is too loose if large loop forms between clutch-arm and take-up spool when camera is started as shown in Figure 5.

3.3.8 Third 10 second film run is for film speed verification. Use a strobotac to verify camera speed. Observations can be made of the shutter or the feed sprocket, see Figures 4-6 and 4-7 of Reference (a). At 400 frames per second (FPS) the shutter and feed sprocket rotate at 24,000 RPM.

NOTE: Film speeds between 390 and 410 frames per second (FPS) are acceptable. If the speed exceeds these tolerances, a qualified technician should examine the mechanism.

3.3.9 Reconnect the internal connector MS3116P-10-6S, see Figure 5 and repeat paragraphs 3.3 through 3.3.8 on the other mechanism of the FEI camera pod.

## SECTION IV

### 4.1. General

This section describes the checkout procedure for the FEI system as installed in the BQM-34A/S or BQM-34E/T. The cameras are checked individually during this test to verify proper operation of the mechanisms and timing lights.

Data presented herein constitutes a quality control acceptance check to be performed on each FEI system installation.

Test equipment is listed in Table I. A test setup shall be assembled as shown in Figure 6 using equipment listed in Table I. Camera operation shall be controlled and observed individually by the appropriate connections as shown, i.e., connect test cable J2-P2B(-4) to test Pod 1, and test cable J3-P3B(-5) to test Pod 2.

### 4.2. Preliminary Check

#### 4.2.1 Visual Inspection

Visually inspect the system installation for obvious faults or evidence of poor workmanship.

### 4.3. Functional Test

4.3.1 The functional test is conducted to verify proper operation of the camera mechanisms and timing lights. No film is used in this test. One camera at a time shall be operated to assure proper operation. Alternately remove internal pod connectors from each camera while performing test, as shown in Figure 6.

#### 4.3.2 Test Procedure

Turn ON Time Code Generator and allow 2 minutes for warm-up. Record comments and results of the following tests on the test data sheet.

4.3.2.1 Repeat paragraph 1.3.2.1. Observe proper lamp operation on the Test Box and also Slow Speed (20 FPS) camera operation.

4.3.2.2 Repeat observation of paragraph 1.3.2.2. Observe proper lamp operation on the Test Box and also the camera motor stopped.

4.3.2.3 Repeat paragraph 1.3.2.3. Observe proper lamp operation on the Test Box, normal speed (400 FPS) camera operation, and timing lights flashing in the pod under test.

4.3.2.4 The previous steps shall be repeated with appropriate connections to test each of the four system cameras individually. See Figure 6.

4.4. Upon successful completion of the tests presented herein, the FEI camera system is considered functionally acceptable for scoring operations.

4.5. Prior to a scoring operation (within 72 hours) load film in all four

(4) cameras per paragraph 3.3.4.

4.5.1 Assemble FEI pods using instructions presented in Section V, Assembly Procedure, paragraph 5.1.

4.5.2 Adjust lens f/stop setting using advice of a qualified photo technician. Lenses are installed according to instructions presented in Section V, Assembly Procedure, paragraphs 5.1.3 through 5.1.7.

CAUTION: Do not remove lens covers until final ground check of target.

4.5.3 Film advancement (slow speed, 20 frames per second).

Each time stand-by power is applied to the FEI system, the camera's slow speed circuit is energized for three (3) seconds. This will advance the film approximately 18 inches thus placing new film in the climbing loop area. The film is advanced in this way to eliminate potential film jamming caused by the film having taken a "set" in the climbing loop area. See Figure 5.

4.5.4 Completion

At completion of system test and service procedures presented herein, the FEI system is then considered acceptable for scoring operations. Insure lubrication is performed in accordance with paragraph 5.3.2.

SECTION V

FEI Camera Pod Assembly and Disassembly Procedure.

5.1. Assembly Procedure

The following procedure describes the steps required to assemble an FEI camera pod.

5.1.1 Holding the pod center body securely, slide the body assembly carefully and slowly longitudinally over the camera mechanism toward the center body. Engage bolt in hole in end of body assembly and firmly seat body assembly into the groove in the center body. Repeat for other body assembly, see Figure 7.

CAUTION: EXTREME CARE MUST BE EXERCISED TO PROTECT THE PROTRUDING MEMBERS IN THE CAMERA MECHANISM

NOTE: MAKE CERTAIN O-RING IS IN CENTER BODY GROOVE. SEE FIGURES 3 AND 7.

5.1.2 Place hand-knob on bolt protruding through the end of the body assembly and rotate clockwise until firmly seated. Torque to 80-100 inch-pounds. Repeat for other hand-knob.

NOTE: Make certain O Ring is on hand-knob. See Figure 7.

5.1.3 With the lens cover over the lens, lower the lens into the opening in the body assembly WITHOUT installing the lens O-Ring (See Figure 8). Engage threads in the lens mount on camera mechanism and rotate clockwise until firmly seated. This then establishes the proper focal length.

5.1.4 Place a mark on periphery of lens body and side of body assembly as shown in Figure 9.

5.1.5 Remove lens by reversing step 5.1.3.

5.1.6 Install O-Ring in the groove in the body assembly as shown in Figure 8.

5.1.7 Reinstall lens into body assembly as in step 5.1.3. Note the increased friction resulting from compressing O-Ring; however, lens must be seated until marks align as in step 5.1.4.

NOTE: New scribe lines must be used each time a new lens or camera mechanism is substituted.

CAUTION: DO NOT TOUCH LENS SURFACE!

Repeat steps 5.1.3 through 5.1.7 for other lens.

NOTE: Seating lens properly is MANDATORY to insure proper focus and to insure an air seal since the assembled pod is a sealed unit.

5.1.8 Slide cone over flanges on end of body assembly and secure to body

assembly by using six No. 10 screws on TE21300. Repeat for other cone.

5.2. Pod Disassembly Procedure (See Figure 7)

5.2.1 Remove lens by placing lens cap over lens such that detents in lens cap engage pins on periphery of lens. Rotate five turns counterclockwise, noting that initial resistance is caused by the compressed O-Ring under the lens body. Carefully lift lens out of pod. Repeat for second lens.

CAUTION: DO NOT TOUCH LENS SURFACE.

5.2.2 Remove nose and tail cones from both ends by removing the six No. 10 screws on each cone of TE21300 and slide longitudinally away from pod body. Retain all screws for reuse.

5.2.3 Remove hand knob in center of front and back bulkheads by rotating counterclockwise until free of thread. Repeat for other hand knob.

NOTE: DO NOT LOSE O-RING FROM KNOBS

5.2.4 Remove body assembly by holding the pod center body securely and then carefully and slowly, slide the body assembly longitudinally away from the center body. Repeat for other body assembly.

CAUTION: EXTREME CARE MUST BE EXERCISED TO PROTECT THE PROTRUDING MEMBERS IN THE CAMERA MECHANISM

5.3. Pod Maintenance

5.3.1 Storage If the pods are to be stored for periods longer than 30 days, disassemble per paragraph 5.2 and reassemble per paragraph 5.1 except omitting two (2) each of the following parts:lens, lens O-ring, center body O-ring and hand knob O-ring (see Figure 7). O-rings are removed to prevent them from taking a set.

5.3.2 Lubrication If the pod has not been lubricated for a period exceeding 6 months, it should be lubricated per paragraph 4.5 of reference (a).

NOTE: Lubrication shall also be performed after every three (3) spools of film or 120 seconds of operation.

REFERENCE

- (a) Teledyne Camera Systems  
Arcadia CA 91006  
Operating and Service Manual  
DBM-11A  
16 MM High Speed Motion Picture  
FEI Pod Camera
- (b) Ground Station, Time Base Coder;  
Schematic Diagram NADC D-ME 15577

TABLE I  
LIST OF TEST EQUIPMENT

<u>Equipment</u>	<u>Range</u>	<u>Model</u>	<u>Manufacturer</u>
Power Supply (DC)	28V DC $\pm$ 10%; 10A Load, 15A Surge Capability	TR36-12M	Electronic Research Associates, Inc.
Multimeter	50V DC; Resistance	260	Simpson
Wristwatch	Sweep second hand or digital display	N/A	N/A
Time Code Generator	24-Hour Clock with IRIG "B Code"	5140	Astrodata
Time Base Coder Ground Station	Reference (b)	F-ME 18642-1	NAVAIRDEV/CEN
FEI Camera Control Test Box	See Figure 10	N/A	N/A
Strobotac	120 to 250,000 RPM	1531-A6	General Radio
Oscillograph Recorder	1 to 64 inches per second 4 channels	5-124A	CEC
Oscilloscope	D.C. 33MHz 50V/CM with dual channel plug Model 82	585A	Tektronix
Cables and Connectors	As per Figures 11A and 11B Note: Some cables and connectors common to more than one figure.	N/A	N/A

NOTE

1. Equivalent equipments may be substituted.

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TEST DATA SHEET (1 of 2)  
FEI CAMERA SYSTEM

CCB S/N \_\_\_\_\_ DATE \_\_\_\_\_ BY \_\_\_\_\_

SECTION I

SECTION II

POD 1                  POD 2  
WIRING                  WIRING

- 1.2.1      Visual Inspection
- 1.3.2.1     Lamps
- 1.1.2.2    3 - second delay
- 1.3.2.3    Lamps and  $10 \pm 1$  sec.
- 1.3.2.5    "        $20 \pm 1\frac{1}{2}$  sec.
- 1.3.2.7    "        $40 \pm 2$  sec.
- 1.3.2.11   Timing Lights
  - J4 (Pod 1)
  - J8 (Pod 2)
- 1.3.2.14   Oscillograph recording

Section III

- 3.3.7      Brake Operation
- 3.3.8      Clutch Operation
- 3.3.9      Film Speed
- 3.3.10     Brake Operation
  - Clutch Operation
  - Film Speed

TEST DATA SHEET (2 of 2)  
FEI CAMERA SYSTEM

CCB S/N \_\_\_\_\_ DATE \_\_\_\_\_ BY \_\_\_\_\_  
TARGET \_\_\_\_\_

SECTION IV

POD 1                          POD 2

CAM 1                          CAM 1                          CAM 2                          CAM 2

S/N \_\_\_\_\_ S/N \_\_\_\_\_ S/N \_\_\_\_\_ S/N \_\_\_\_\_

4.2.1 Visual Inspection

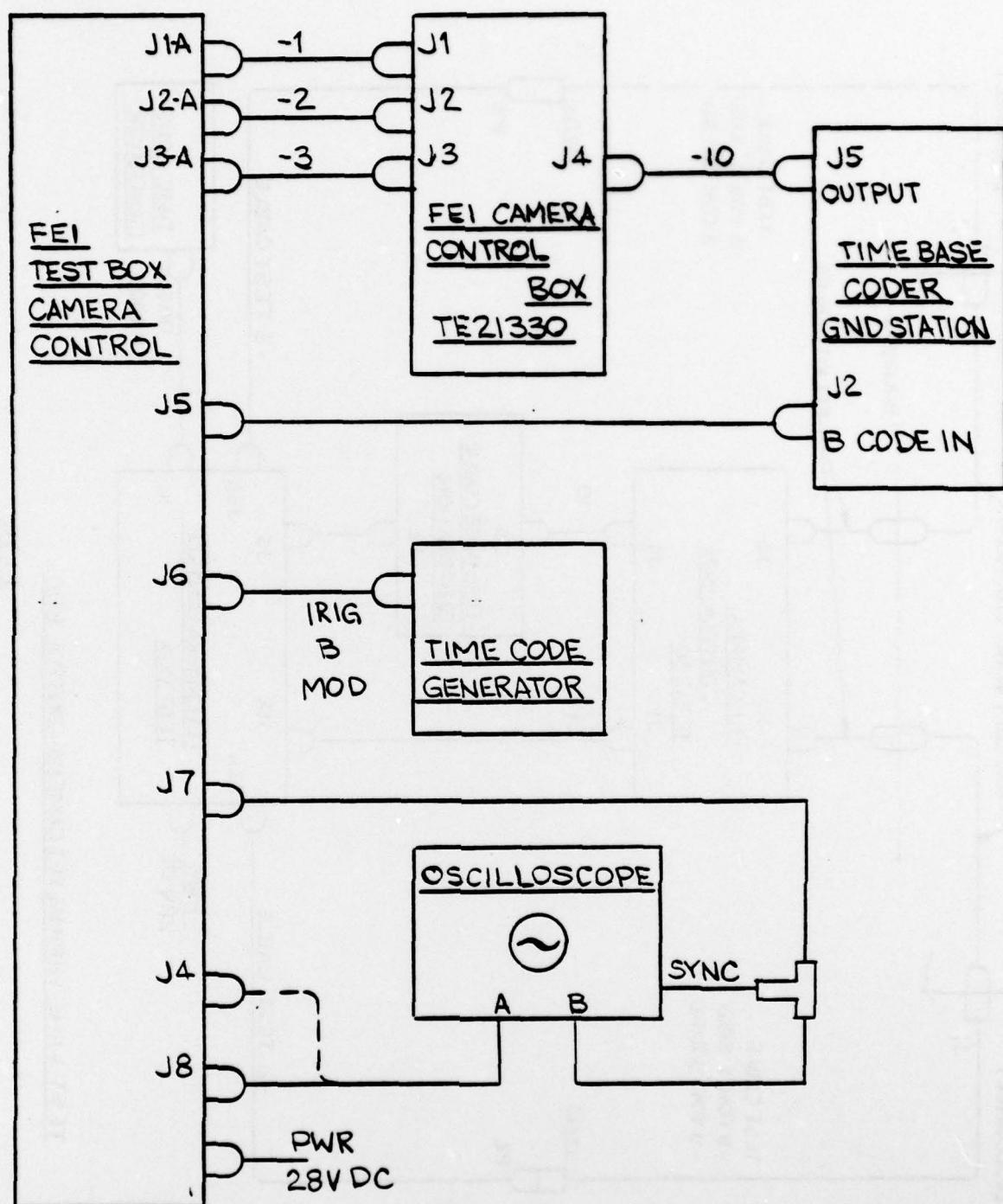
4.3.2.1 Lamps  
Slow Speed

4.3.2.2 Lamps  
Motor Stopped

4.3.2.3 Lamps  
Normal Speed  
Timing Lights

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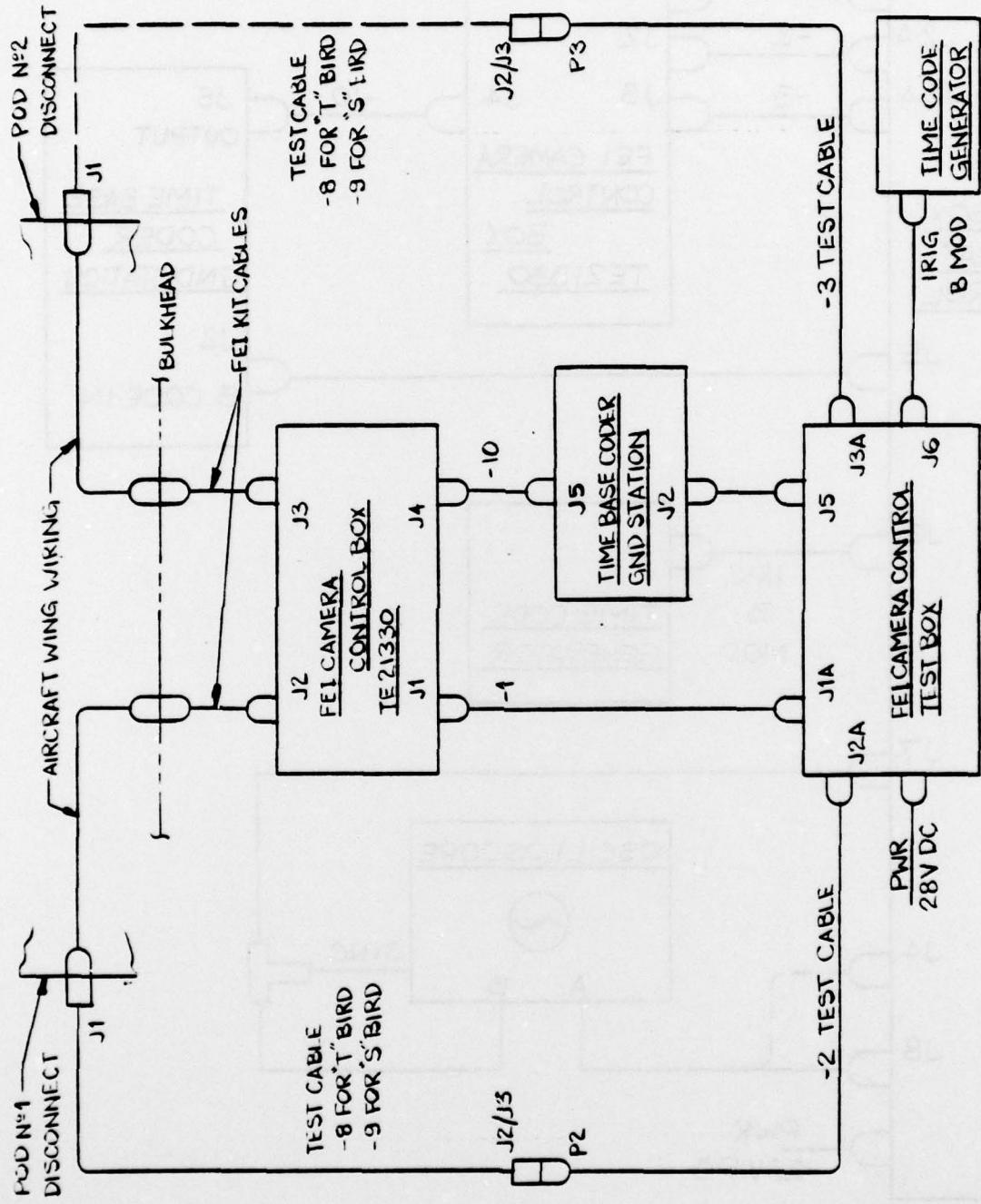
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TEST SET-UP, FEI CAMERA CONTROL BOX

FIG 1

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TEST WIRING, FEI CAMERA CONTROL BOX

FIG 2

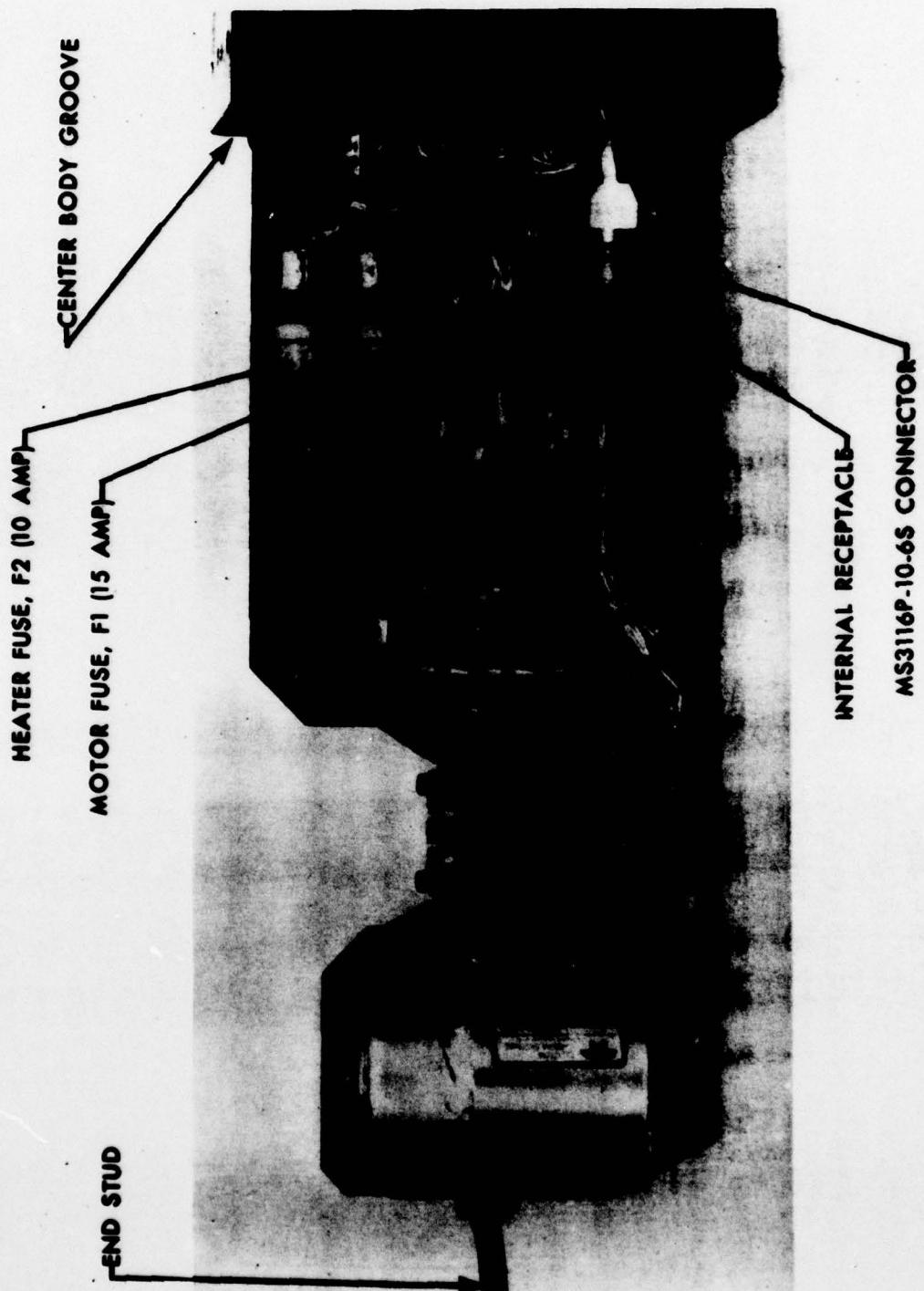
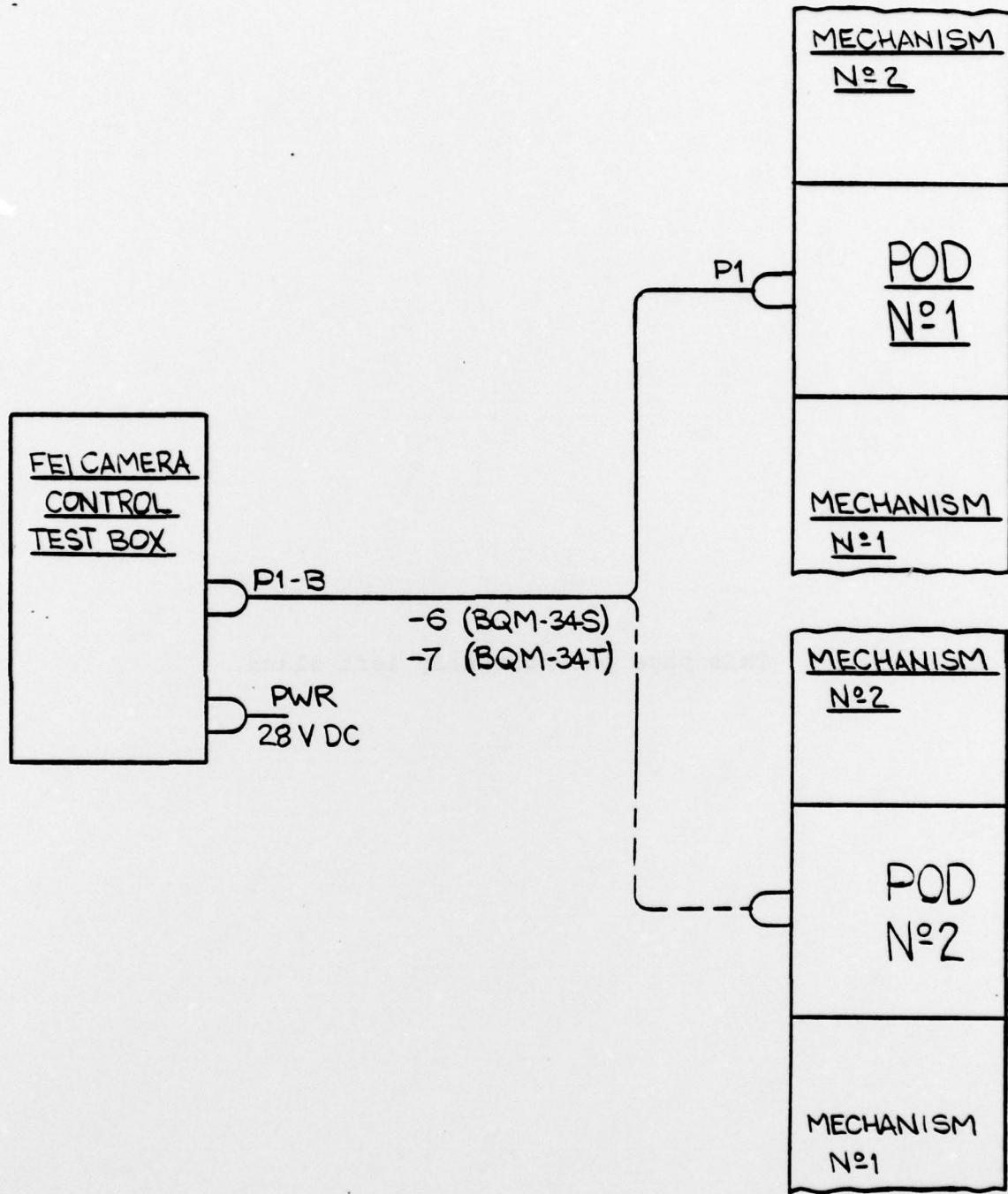


FIGURE 3 MECHANISM - BACK VIEW

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FEI CAMERA POD TEST

FIG 4

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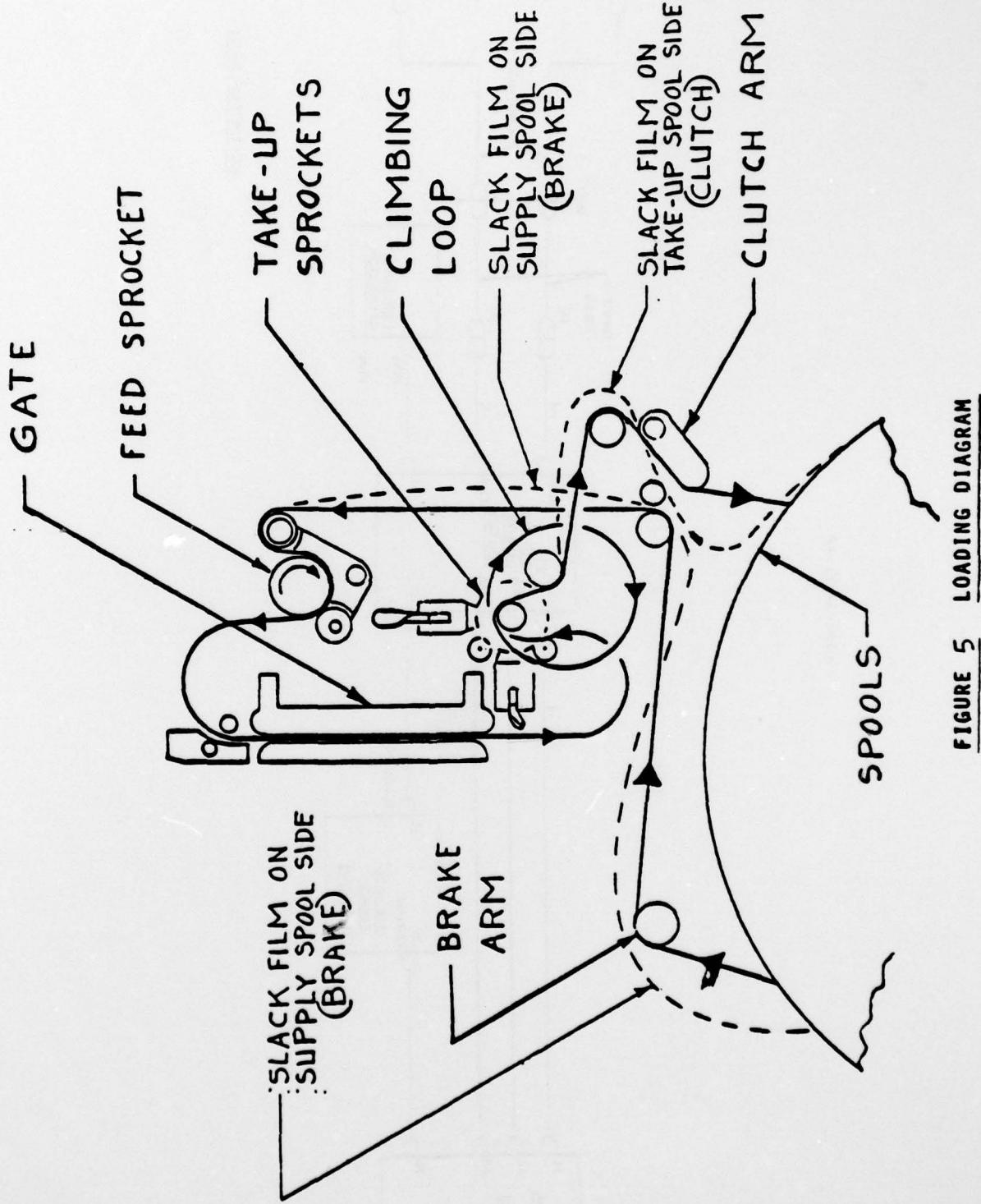
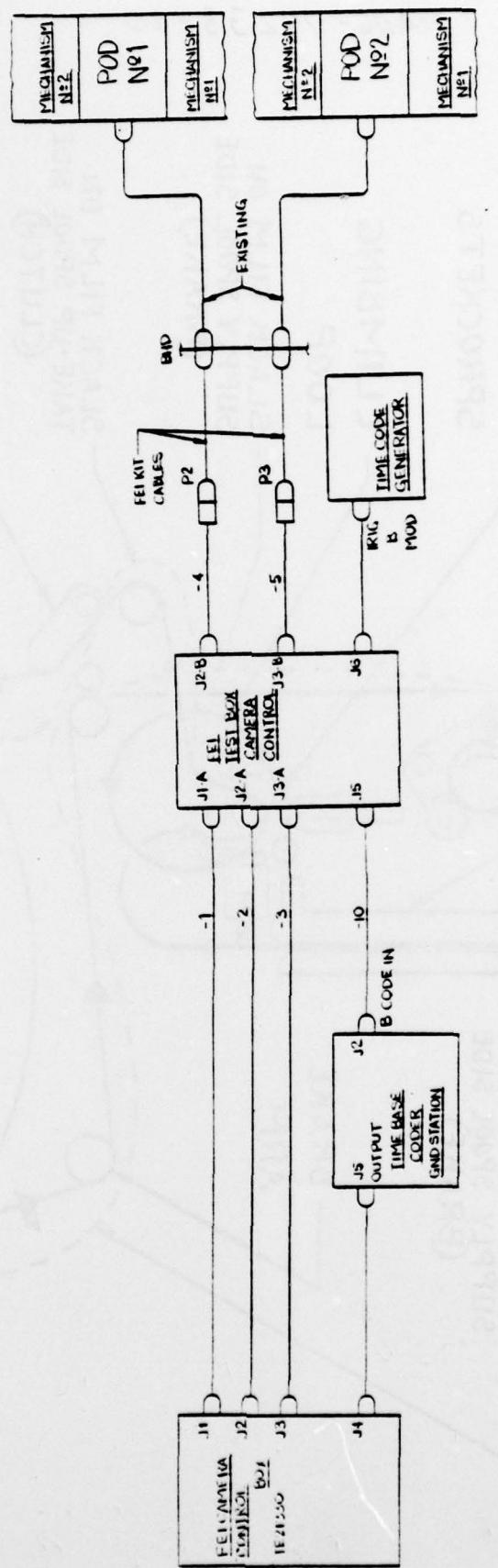


FIGURE 5 LOADING DIAGRAM

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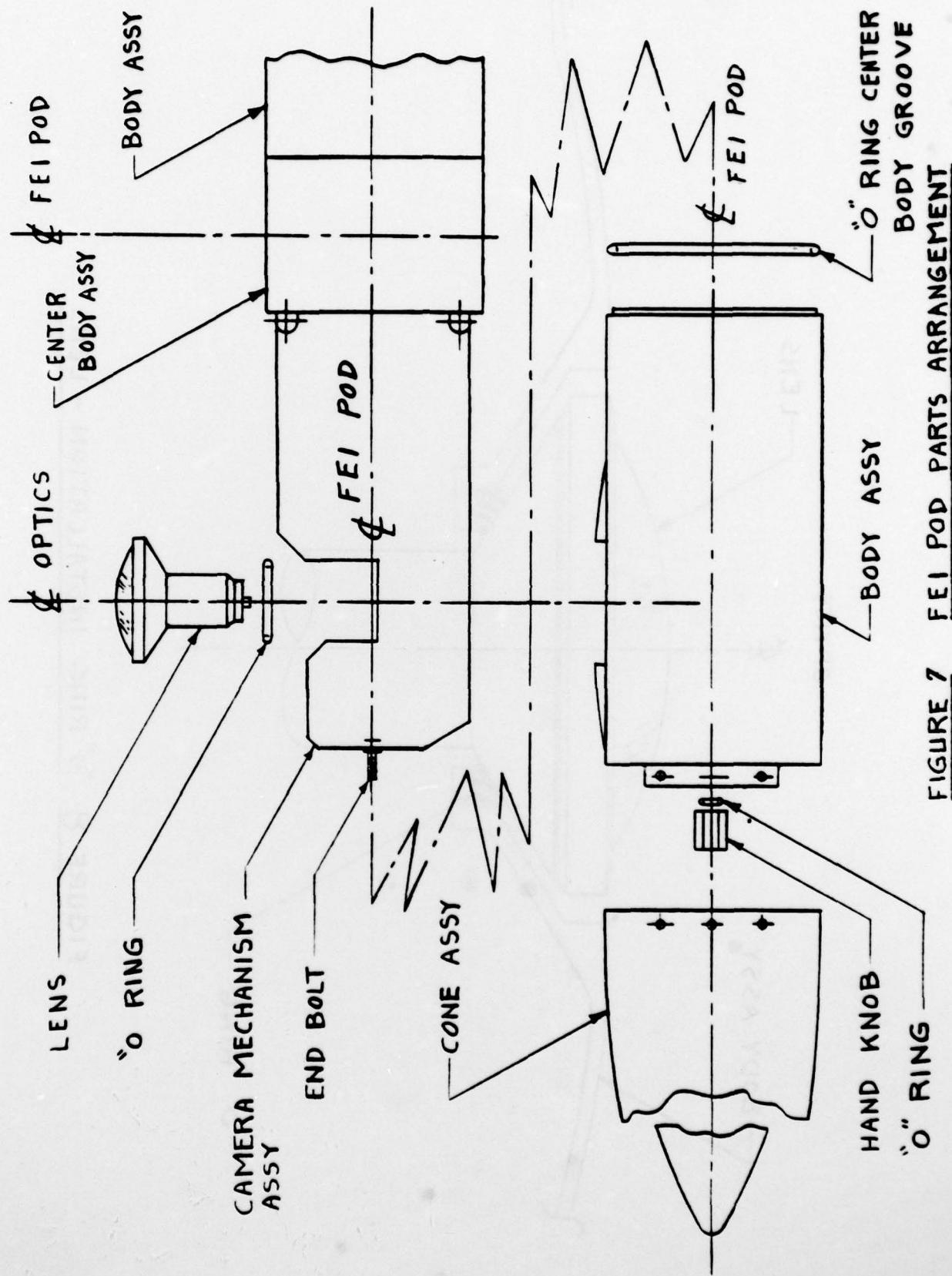


FIGURE 7

FEI POD PARTS ARRANGEMENT

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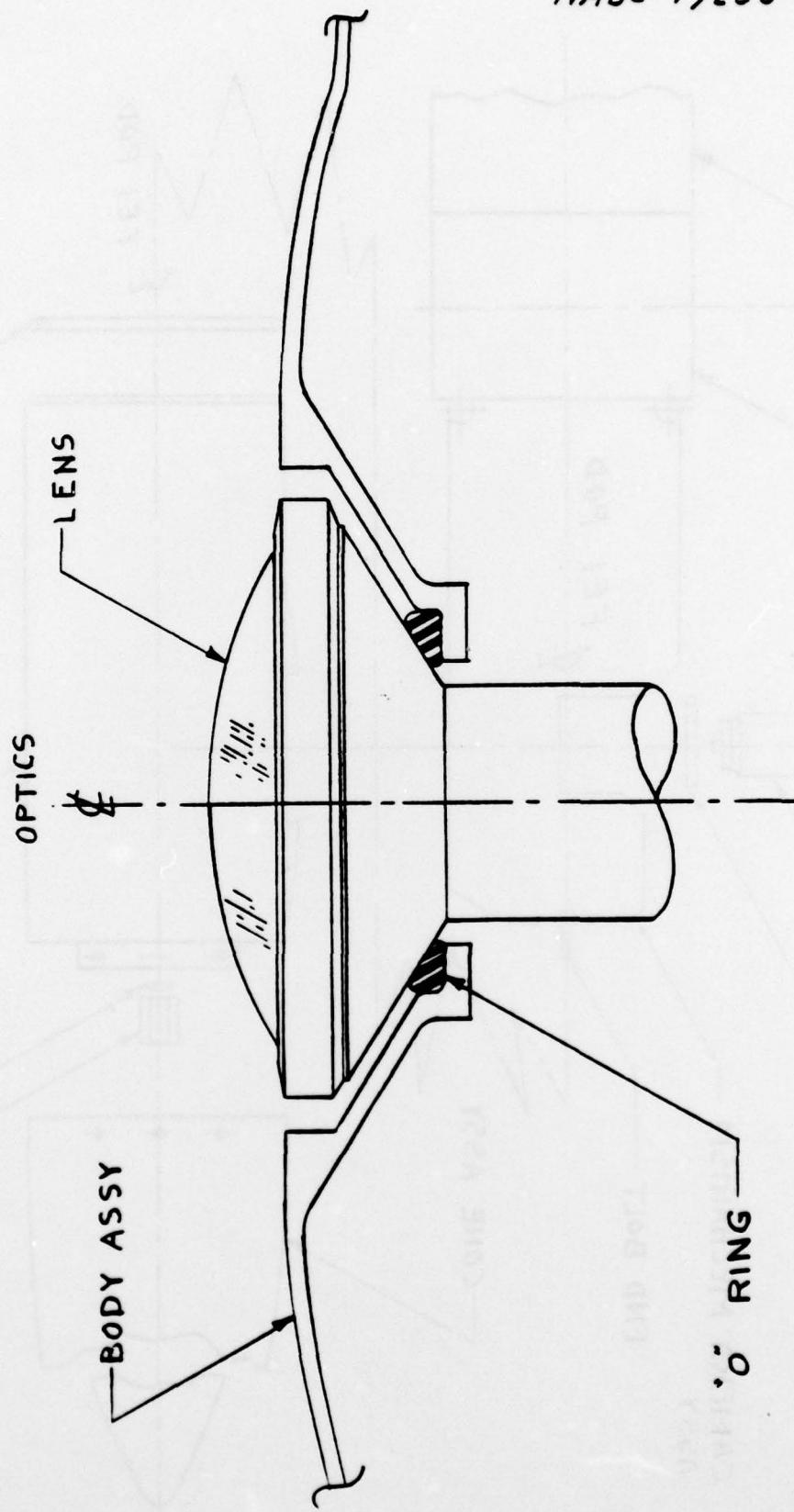


FIGURE 8 'O' RING INSTALLATION - LENS

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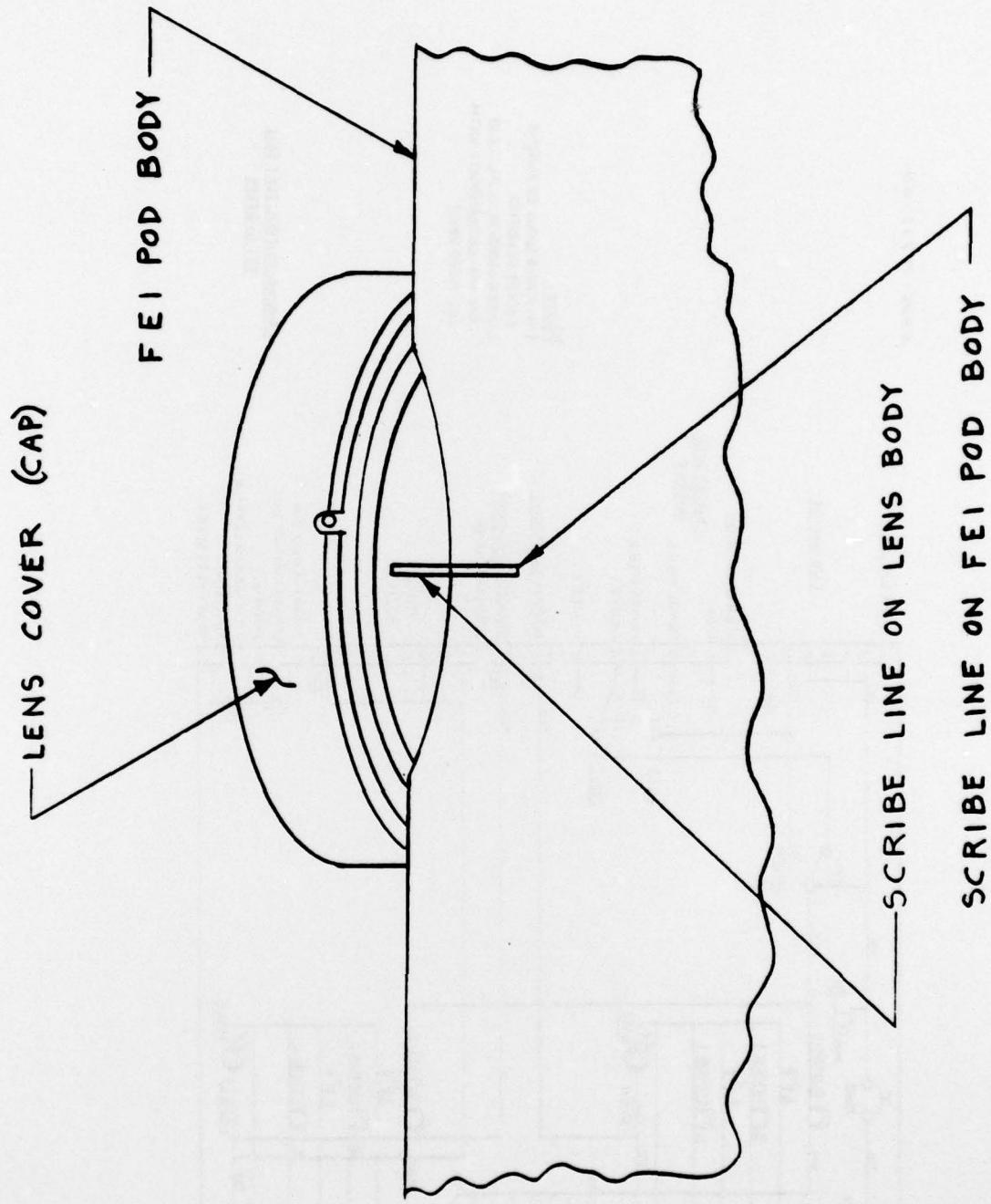
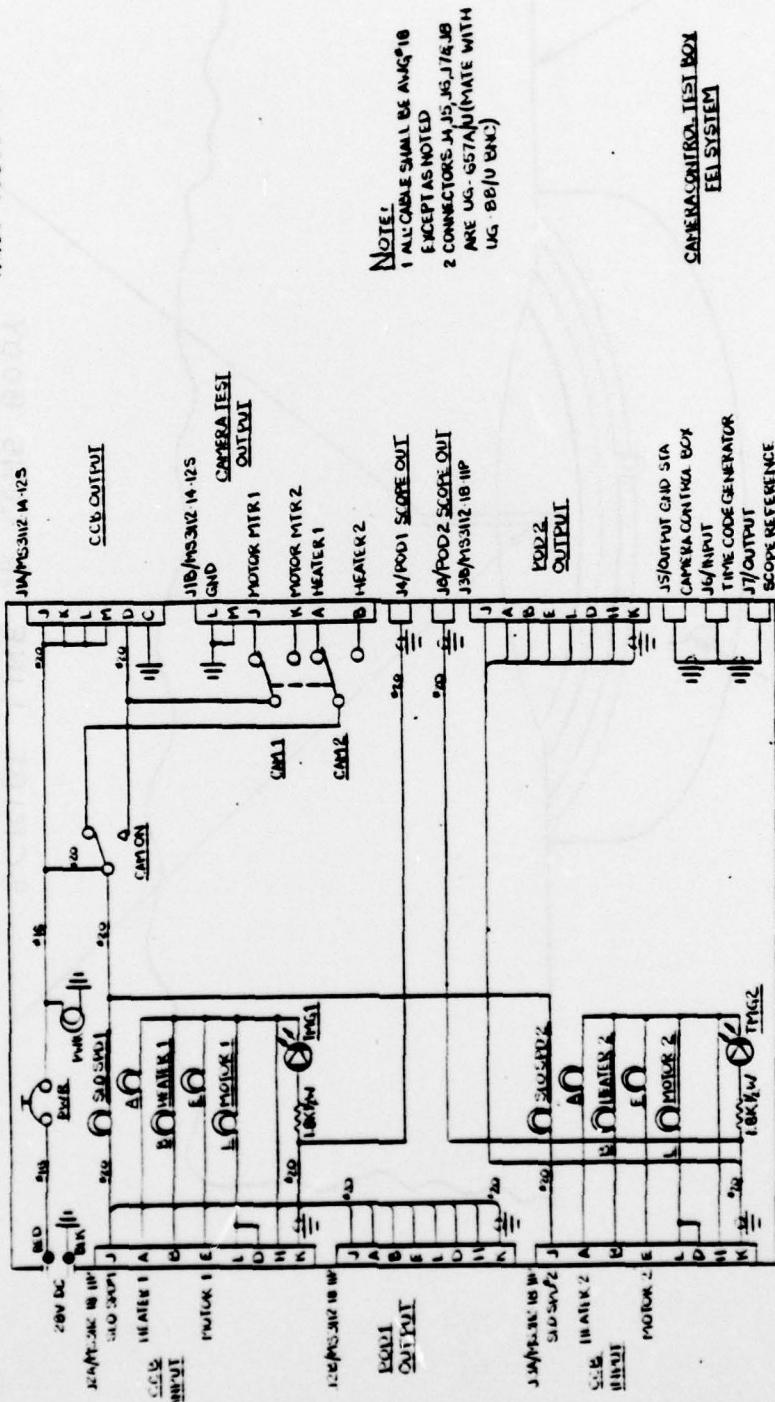
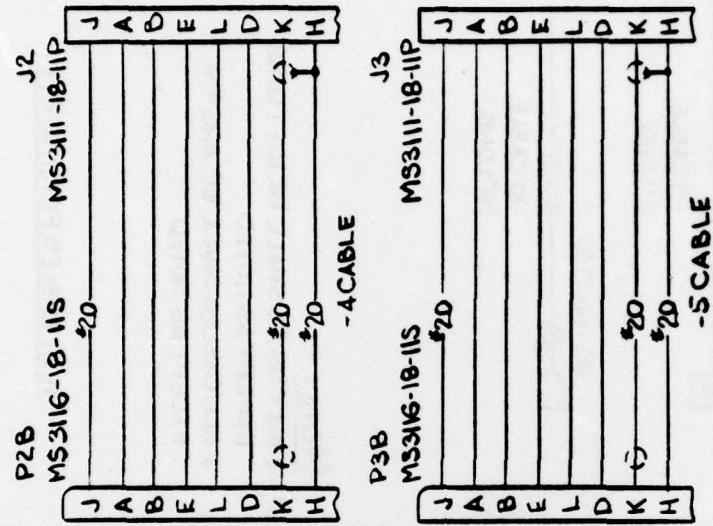
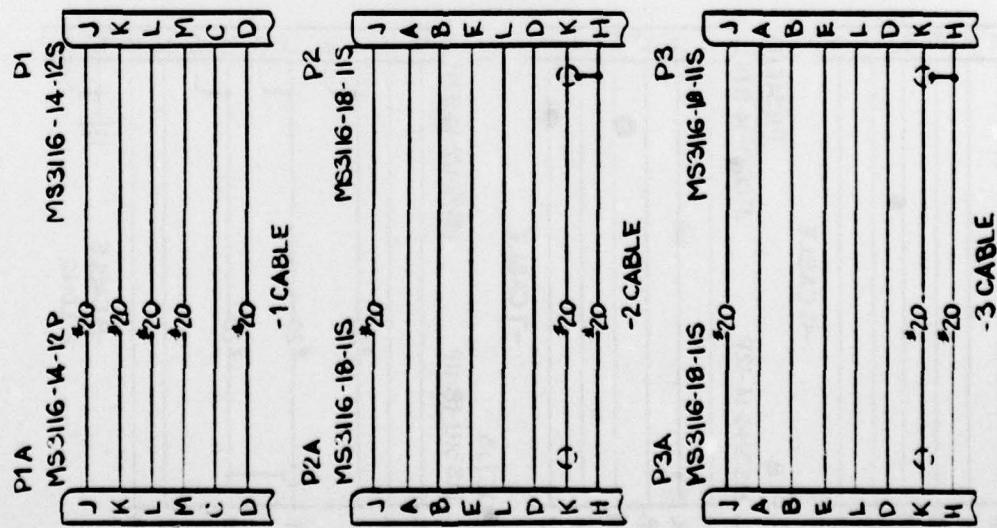


FIGURE 9 LENS INSTALLATION

NADC-19233-60



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NOTE:  
1 ALL CABLES SHALL BE 10FT LONG  
2 ALL CABLES SHALL BE AWG #18  
EXCEPT AS NOTED

TEST CABLES, FEI SYSTEM

FIG 1A

NADC-79233-60

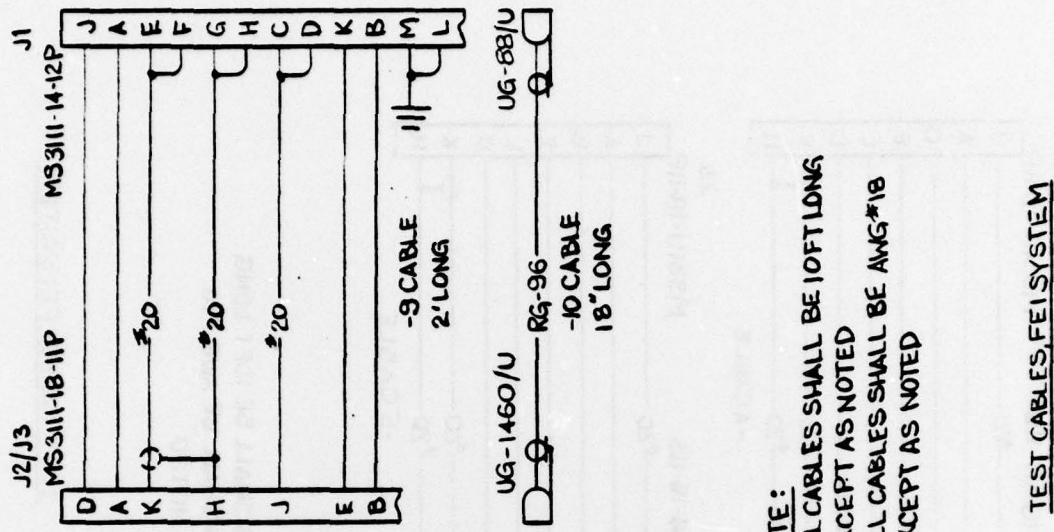
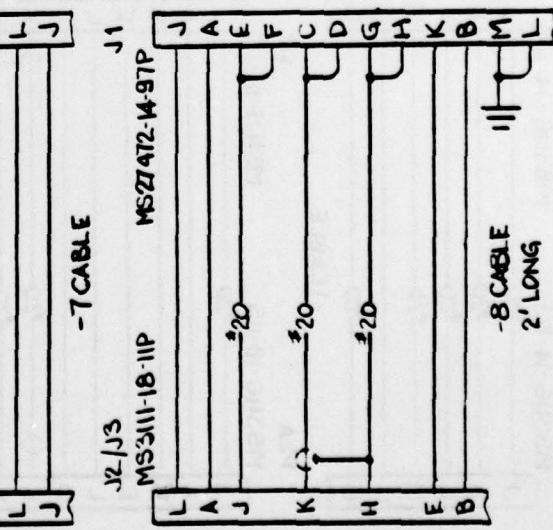
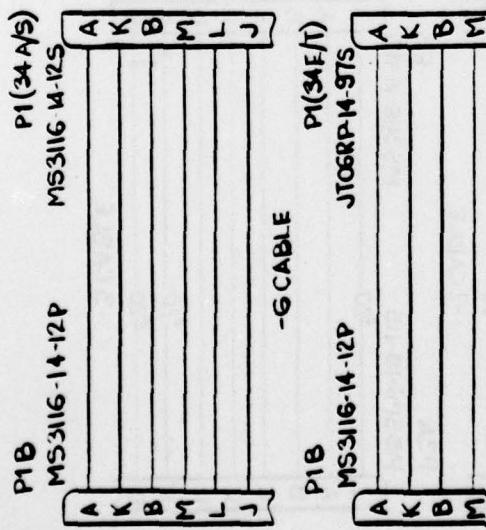


FIG 11B

D I S T R I B U T I O N   L I S T

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